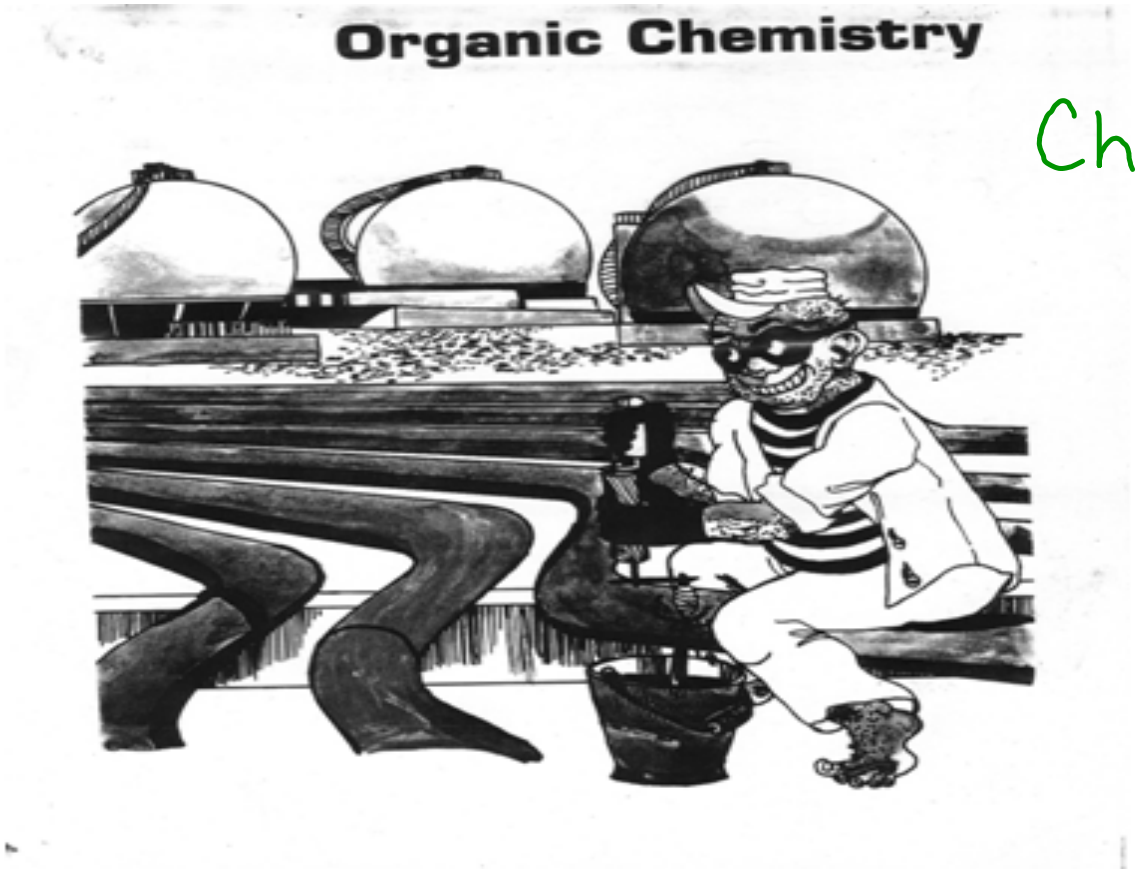

Organic Chemistry
Ch 22

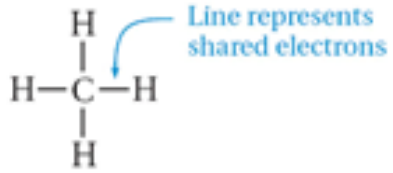
Connecting to Your World

Gasoline, diesel fuel, and kerosene are examples of liquid fuels. A solid fuel, coal, produced the steam for the locomotives that pulled old-time trains. These fuels are mixtures of compounds called hydrocarbons. You will learn about the structure and properties of hydrocarbons.

22.1 Hydrocarbons > Organic Chemistry and Hydrocarbons

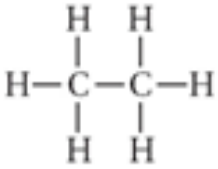
Formulas and Models for Methane and Ethane

Structural formula | Ball-and-stick model | Space-filling model



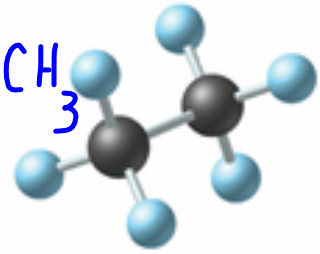
Methane (CH_4)

CH_4



Ethane (C_2H_6)

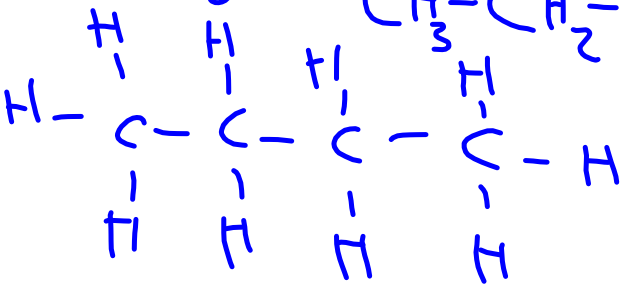
CH_3-CH_3

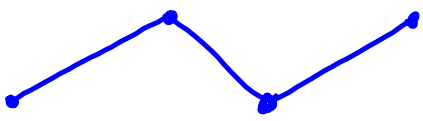


C_2H_6

C_3H_8 $CH_3-CH_2-CH_3$

C_4H_{10} $CH_3-CH_2-CH_2-CH_3$





The carbon atoms in an alkane can be arranged in a (1) straight chain or in a chain that has (2) branches.

(Substituents)

(groups)

A group of compounds forms a **homologous series** if there is a constant increment of change in molecular structure from one compound in the series to the next.

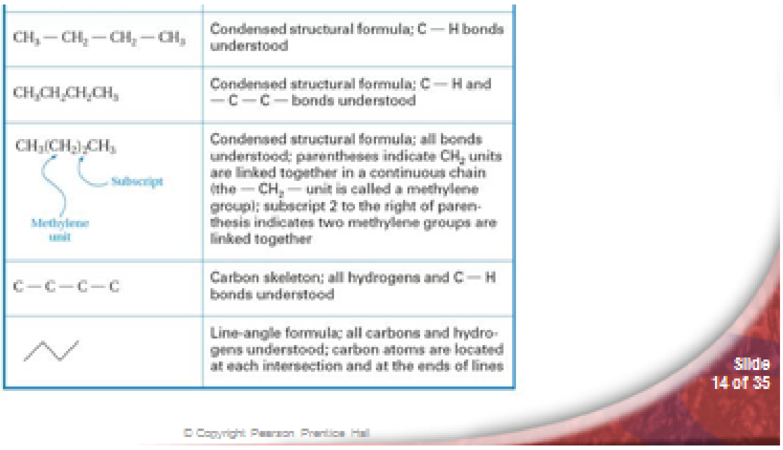
Table 22.1

The First Ten Straight-Chain Alkanes			
Name	**Molecular formula**	**Structural formula**	**Boiling point (°C)**
Methane	CH_4	CH_4	−161.0
Ethane	C_2H_6	CH_3CH_3	−88.5
Propane	C_3H_8	$CH_3CH_2CH_3$	−42.0
Butane	C_4H_{10}	$CH_3CH_2CH_2CH_3$	0.5
Pentane	C_5H_{12}	$CH_3CH_2CH_2CH_2CH_3$	36.0
Hexane	C_6H_{14}	$CH_3CH_2CH_2CH_2CH_2CH_3$	68.7
Heptane	C_7H_{16}	$CH_3CH_2CH_2CH_2CH_2CH_2CH_3$	98.5
Octane	C_8H_{18}	$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_3$	125.6
Nonane	C_9H_{20}	$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_3$	150.7
Decane	$C_{10}H_{22}$	$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_3$	174.1

C_1H_4
C_2H_6
C_3H_8

−161 °C
−42.0 °C
174.1
$C_{10}H_{22}$

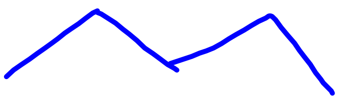
PEARSON Prentice Hall



$CH_3-CH_2-CH_2-CH_3$	Condensed structural formula; C — H bonds understood
$CH_3CH_2CH_2CH_3$	Condensed structural formula; C — H and — C — C — bonds understood
$CH_3(CH_2)_2CH_3$ (Methylene unit; Subscript)	Condensed structural formula; all bonds understood; parentheses indicate CH_2 units are linked together in a continuous chain (the — CH_2 — unit is called a methylene group); subscript 2 to the right of parenthesis indicates two methylene groups are linked together
C — C — C — C	Carbon skeleton; all hydrogens and C — H bonds understood
	Line-angle formula; all carbons and hydrogens understood; carbon atoms are located at each intersection and at the ends of lines

In a **condensed structural formula**, some bonds and/or atoms are left out of the structural formula. Although the bonds and atoms do not appear, they are there.

Ex: pentane C_5H_{12} $CH_3-CH_2-CH_2-CH_2-CH_3$



Alkanes-Single Bonds

- Alkanes all have an ending with ANE
- Naming:
- The prefixes that are used are the same ones that are used for other organic families.
- An ending of ane is used to tell us that the bonds are single

The prefix tells us the number of carbons

- CH_4 methane
- C_2H_6 Ethane
- C_3H_8 Propane
- C_4H_{10} Butane
- C_5H_{12} Pentane
- C_6H_{14} Hexane
- C_7H_{16} Heptane
- C_8H_{18} Octane
- C_9H_{20} Nonane
- $C_{10}H_{22}$ Decane

Study

meth
Eth
Prop
But
Pent
Hex
Hept
Oct
Non
Dec

modes eat peanut butter

General Formula:

C_nH_{2n+2}

# of carbons

Alkanes-single bonds

- Rules for naming

1. Find the longest(parent chain). Number the carbon atoms from the end that contains the most branches (aka alkyl groups or R groups).
2. Identify the alkyl groups and the location number on the parent chain.

NOTE:

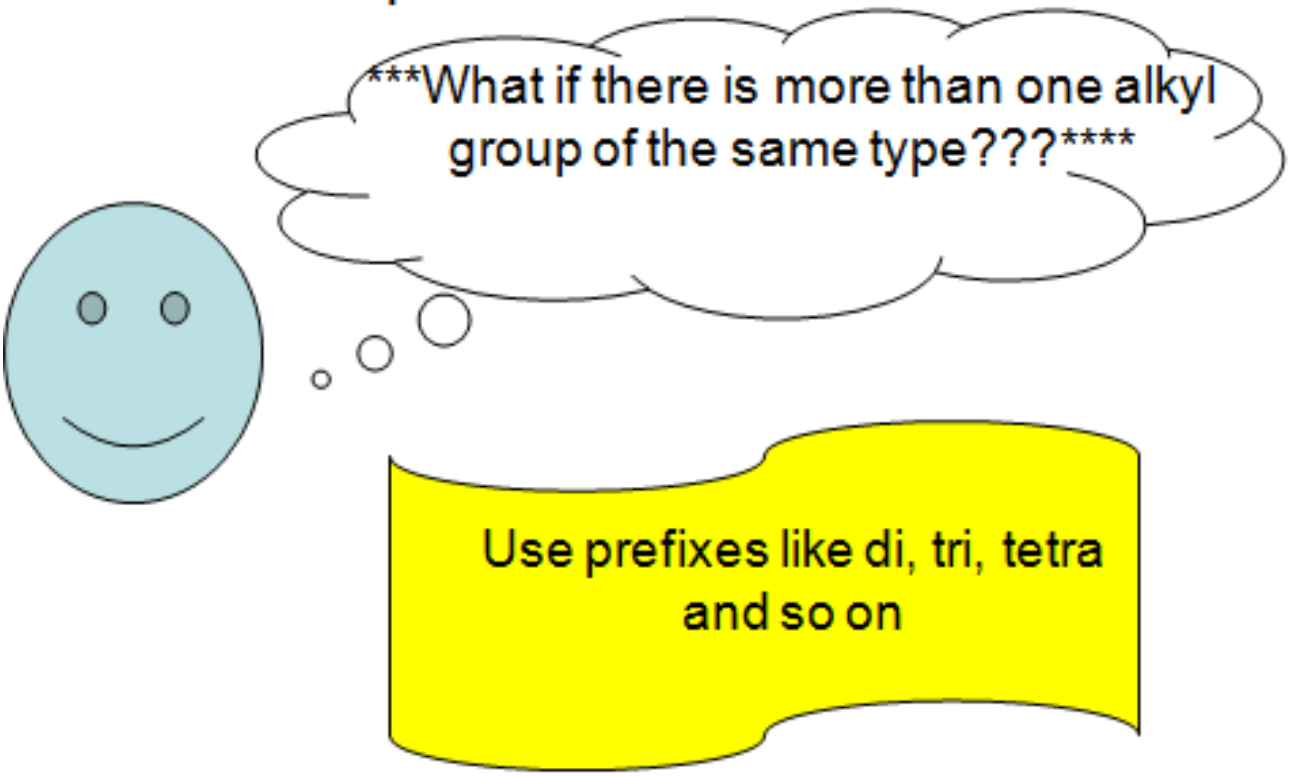
⇨alkyl groups have yl endings

⇨They have the same prefixes

(this tells us how many carbons)

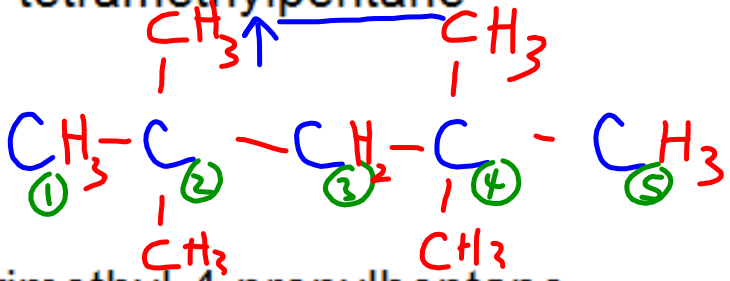
$-CH_3$	methyl
$-C_2H_5$	ethyl
$-C_3H_7$	propyl
and so on…	

3. Write the IUPAC name. Branches are listed in alphabetical order.

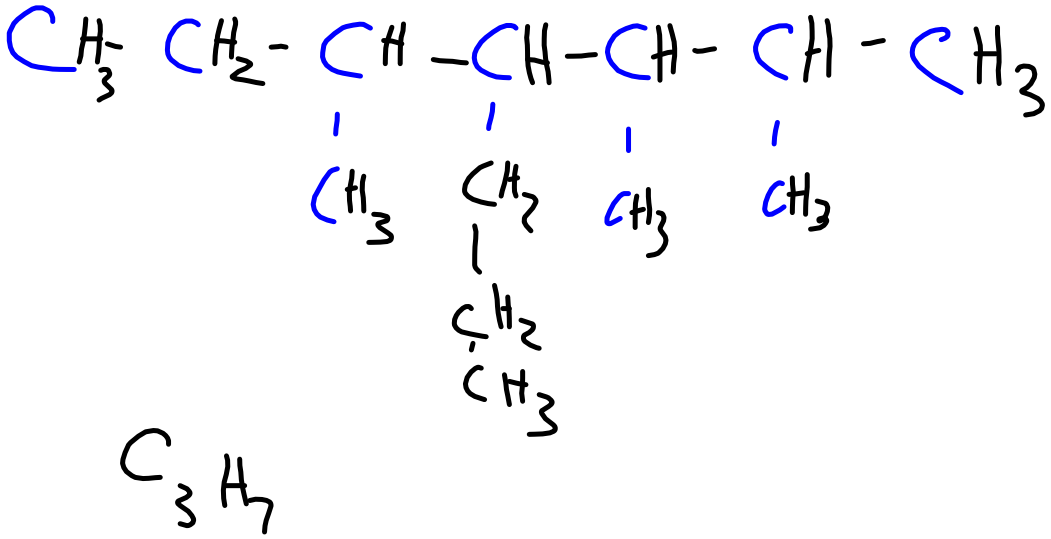


Try these:

- Write the structural formulas
- a. 2,2,4,4-tetramethylpentane



- b. 2,3,5-trimethyl-4-propylheptane



C_3H_7